COURSE TITLE: Foundations of Energy

UNIT TITLE: Renewable Energy–Biomass

SECTION 1: General Information and Overview

Grade Level: 9-12

Suggested Number of Lessons: 6-8

Suggested Time to Complete Unit: 5-10 class periods

Unit Overview: This unit provides an overview of biomass and biofuels as sources of energy and how waste can be transformed into energy.

SECTION 2: Essential Questions

1.	What basic information concerning biomass and biofuels will I need to know regarding the future of energy? (Biomass; Biogas; Waste to Energy to power generation plants)
2.	What processes are involved in changing biomass into biofuels?
3.	How can the use of biomass impact my future as an individual, my family and the economy?

SECTION 3: Major Focus

Technical Content CTE Program of Studies	Learner Activities (Enabling Knowledge and Skills/Processes)	Core Content For Assessment	Academic Expectations
Construction Technology KOSSA Standard AD-002: Demonstrate the ability to learn new processes and steps. **2.1**--Assess the impact of various current and new technologies on the economy. **2.3**--Describe similarities and differences between renewable and	Using the provided PDF files in the *Biomass Unit*: **Research** and **discuss** current and new technologies in relation to waste and energy technology. **View** a video or a power-point on "Biomass and Biofuels." **Identify** key components as: -definition of terms -sources of biomass -products produced from	**SC-HS-4.6.4** Students will: • describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide and oxygen); • explain the movement of matter and energy in biogeochemical cycles and related phenomena. The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of	**2.1** Students understand scientific ways of thinking and working and use those methods to solve real-life problems.

nonrenewable sources of energy. **2.1**--Assess the impact of the various energy sources on the economy of Kentucky. **1.16**--Use computer skills related to concepts of energy in the various types. **6.2**--Identify ways to conserve energy.	various sources of biomass materials -availability of these resources (both raw and finished products) -future trends in the industry **Compare** findings with classmates and agree on definition, availability in Kentucky and future trends both regionally and nationally. **Conduct** a research using resource texts, websites, brochures, booklets and NEED material--*Energy Info book* http://www.need.org/Energy-Infobooks to **identify** and **define** the following terms: -biodegradable -compostable -life cycle assessment -polylactic acid (PLA). **Listen** to a discussion by teacher on the process to be used in group work on "Building a Museum of Solid Waste." From this presentation, **identify** one of the following topics for group work: • Introduction to Solid Waste • Source Reduction • Introduction to Recycling • Recycling Plastics • Recycling Metals • Recycling Paper/Glass • Waste to Energy • Landfills	matter between reservoirs is driven by earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide and in all organisms as complex molecules that control the chemistry of life. **DOK 3** **SC-H-ET-U-7** Explore Waste to Energy Solutions	**5.1** Students use critical thinking skills such as analyzing, prioritizing, categorizing, evaluating, and comparing to solve a variety of problems in real life situations. **6.2** Students use what they already know to acquire new knowledge, develop new skills, or interpret new experiences.

2.1-2.3 Engage in meaningful hands-on minds-on in conceptual-based activities in the area of energy. **5.1--**Compare the pros and cons in the use of the various energy sources.	**Participate** in the group activity identified from the above listing. As a group, **identify** questions needed to research the chosen topic and the answers needed for a presentation to the class. **Use** materials as references, resource texts, booklets, videos and websites to **document** answers. **Develop** a script including visuals, graphs and other display materials for the exhibit and presentation. **Participate** in the presentation of the group's component of the activity *Museum of Solid Waste.* **Evaluate** the group presentation/exhibit using a prescribed rubric. **Take** notes on each group's presentation/exhibit. .		**2.1** Students understand scientific ways of thinking and working and use those methods to solve real-life problems. **6.2** Students use what they already know to acquire new knowledge, develop new skills, or interpret new experiences. **2.2** Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events.
Construction Technology KOSSA Standard AD-003: Implement new processes given oral instructions.	**Participate** in a class discussion on the impact biomass has on an individual, the family and the national economy.	**SC-HS-4.6.5** Students will describe and explain the role of carbon-containing molecules and chemical reactions in energy transfer in living systems. Living systems require a	

2.1-2.3 Engaging in meaningful hands-on, minds-on conceptual based activities in the area of energy technologies.	**Participate** in a jeopardy-type exercise to determine major concepts learned in this unit.	continuous input of energy to maintain their chemical and physical organization since the universal tendency is toward more disorganized states. The energy for life primarily derives from the Sun. Plants capture energy by absorbing light and using it to break weaker bonds in reactants (such as carbon dioxide and water) in chemical reactions that result in the formation of carbon-containing molecules. These molecules can be used to assemble larger molecules (e.g., DNA, proteins, sugars, fats). In addition, the energy released when these molecules react with oxygen to form very strong bonds can be used as sources of energy for life processes. **DOK 3**	
Construction Technology KOSSA Standard EA-005: Display initiative. Students will investigate with teacher guidance the role of biomass and biogas technology in the future of energy.	**Using** the NEED resource CD and the *Secondary info book*, students will **explore** biomass and **investigate** its physical characteristics and **interpret** findings. **Develop** a plan for recycling in the school. **Develop** a plan for the class and **share** with classmates.		**2.3** Students identify and analyze systems and the ways their components work together or affect each other. **2.4** Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics that might be observed. **2.5** Students understand that under certain conditions nature tends to remain the same or move toward a balance.

SECTION 4: Culminating Project with Scoring Guide

Students will build and display a Waste to Energy Expo using 3-sided science fair boards accompanying each expo board with a powerpoint or short video clip.

SCORING GUIDE:

CATEGORY	4	3	2	1
CONTENT	EXTENSIVE- CONTENT BEYOND WHAT IS TAUGHT IN CLASS	GOOD- EXPLANANTION OF CONCEPTS COVERED IN CLASS	BASIC – WHAT HAS ALREADY BEEN COVERED IN CLASS	LIMITED- DOESN'T COVER MATERIAL AS WELL AS DONE IN CLASS
TECHNOLOGY	EXTENSIVE- POWER POINT WITH EXCELLENT ANIMATION AND PICTURES	APPROPRIATE- POWER POINT HAS SOME ANIMATION AND PICTURES	BASIC- POWER POINT WITH LITTLE ANIMATION AND PICTURES	LIMITED – POWER POINT WITH NO ANIMATION OR PICTURES
PRESENTATION	EXCELLENT- FLOWS WELL, AUDIENCE VERY ATTENTIVE- WELL REHEARSED	GOOD – FLOWS WELL PARTICIPANTS KNOW MATERIAL WELL	BASIC – FLOWS UNEVENLY MAY HAVE SOME READING OF NOTES OR SLIDES	LIMITED- PARTICIPANTS READ FROM NOTES OR SLIDES
INTEREST	EXTENSIVE – PARTICIPANTS MAKE MANY EXTENSIONS AND EXPLANATIONS	APPROPRIATE – ENCOURAGES QUESTIONS AND COMMENTS	BASIC – CAN FIELD SOME QUESTIONS	LIMITED – GLAD TO BE THROUGH WITH THE PRESENTATION

SECTION 5: Assessment and Enabling Skills and Processes

Assessment:	Waste to Energy Exhibit/Expo and presentation, Plan of Action for Recycling, group work, class notebook

SECTION 6: Support Materials (i.e., Resources, Technology, and Equipment)

A. Resources	NEED materials, (Biomass folder, Museum of Solid Waste), videos, film clips and web-sites (Biomass Biofuels in Kentucky), www.energy.ky.gov
B. Technology	Personal tools, computer, LCD projector
C. Websites (samples of many available)	WWW.need.org; www.eia.gov; www.doe.gov; Google
D. Equipment	Glue guns and supplies, science fair boards